GRIDSENSE™

PowerMonic Circuit Connections for Australasian Markets

1. Introduction

This document provides guidelines and recommendations for connections to typical low voltage circuits. It is an addition to the PowerMonic Installation & Users Manual and outlines the use and connection to Australasian low voltage circuits.

2. PowerMonic Voltage Cables & Accessory Items

The PowerMonic has 4 different types of main cables, being:

1. **PC4**: Single Phase, AC wall plug cable (Fig. 1) used to power up the PowerMonic to configure, download and monitor household single phase voltages
2. **VL3**: A three-wire voltage cable (Fig. 2) used on Delta voltage connections
3. **VL4**: A four-wire voltage cable (Fig. 3) used on Wye and Split circuit (single-bushing transformer-multi-grounded primary circuits) voltage connections.
4. **VL6**: A six-wire voltage cable (Fig. 4) that can be used on Delta, Wye and Split circuit (single-bushing transformer-multi-grounded primary circuits) voltage connections.

Figure 1 - PC4-2 Single phase

Figure 2 - VL3-2 Delta cable

Figure 3 - VL4-2 Wye cable

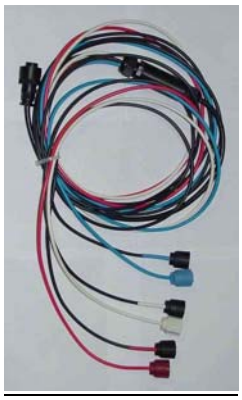

Figure 4 - VL6-2 Wye/Delta cable

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gridsense.com

Figure 5 – 4mm banana plug, small alligator clamps

Figure 6 – Tinned ends (bare wire)

Figure 7 – Large clamps

The PowerMonic voltage cables are double insulated and UV stabilized and suitable for indoor and outdoor installations. Each phase of the voltage cable is separately fused and there are various voltage cable attachments available to suit different types of installations, for example, 4mm Banana Plug, Small Alligator Clamps (Fig. 5), Tinned (bare wire) Ends (Fig. 6), and Large Clamps (Fig. 7).

3. PowerMonic Voltage Cables Colour Coding

The table below compares the phasing colour codes for the Australasian markets:

Voltage	Australasia
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral	Black

4. PowerMonic Configuration Settings

The PowerMonic does ***not*** assume that it is connected to a balanced three phase system. It should be configured the same as the circuit connection the PowerMonic is measuring.

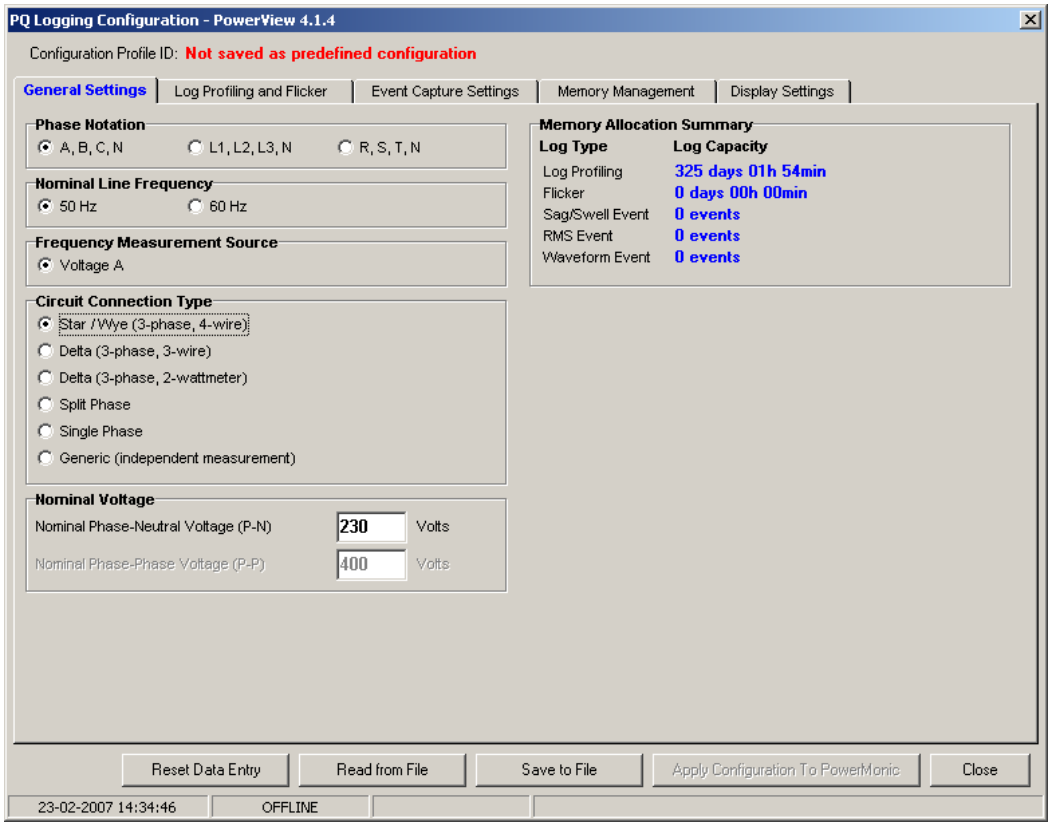


Figure 8 – PQ Logging Configuration Screen

When configuring the PowerMonic, there are 4 configuration settings that correspond to the circuit connection on voltage (Fig. 8).

a. Phase Notation = A,B,C,N or L1,L2, L3,N or R,S,T,N

b. Nominal Line frequency = 50Hz Europe/Australasia, 60Hz North America

c. Voltage Cable Connection = must be the same as the physical connection.

d. Nominal Voltage = Phase-Phase voltage for Delta connection, Phase-Neutral voltage for Star/Wye connection.

Note: Before shipment, GridSense configures the nominal line frequency to 50Hz or 60Hz based on the application area. If this has been inadvertently set to 60Hz, change the nominal line frequency, then reset the PowerMonic by cycling the PowerMonic power off and on again. Alternatively, change the nominal line frequency, then reset the PowerMonic using PowerView by selecting the Reset PowerMonic button in the Advanced Controls menu. It is **only** necessary to reset the PowerMonic if the nominal line frequency is changed.

5. Summary of PowerMonic Connections

The table below provides a summary of the various circuit connections on which the PowerMonic can be installed. The table highlights which voltage lead assembly can be used, the voltage connection type and Nominal RMS Voltage settings to be used in the PowerMonic configuration parameters. Detailed connection diagrams for each circuit can be found on the following pages.

Ref.	Source Type	Load Type	Voltage Cable	Voltage Connection	Nominal Voltage
5.1	3 Phase, 4 Wire (Wye)	Start (Wye)	VL4, VL6	Star (Wye)	Phase-Neutral
5.2	3 Phase, 3 Wire, 3 Watt (Delta)	Delta	VL3, VL6	Delta	Phase-Phase
5.3	3 Phase, 3 Wire, 2 Watt (Delta)	Delta	VL3, VL6	Delta	Phase-Phase
5.4	Split Phase	2 Single Phase	VL4, VL6	Star (Wye)	Phase-Neutral
5.5	Single Phase	Single Phase	PC4, VL4, VL6	Start (Wye)	Phase-Neutral
5.6	Generic	3 Single Phase	VL6	Star (Wye)	Phase-Neutral
5.7	3 Phase, 3 Wire (Wye)	Delta	VL3, VL6	Delta	Phase-Phase
5.8	3 Phase, 3 Wire (Wye)	3 Single Phase	VL3, VL6	Delta	Phase-Phase
5.9	Delta Mid-Tap	2 Single Phase	VL4, VL6	Star (Wye)	Phase-Neutral

The circuit connections fall into two categories:

1. **Neutral line connection**. This includes connections 5.1, 5.4, 5.5, 5.6 and 5.9. The phase-neutral voltages and line currents are measured.

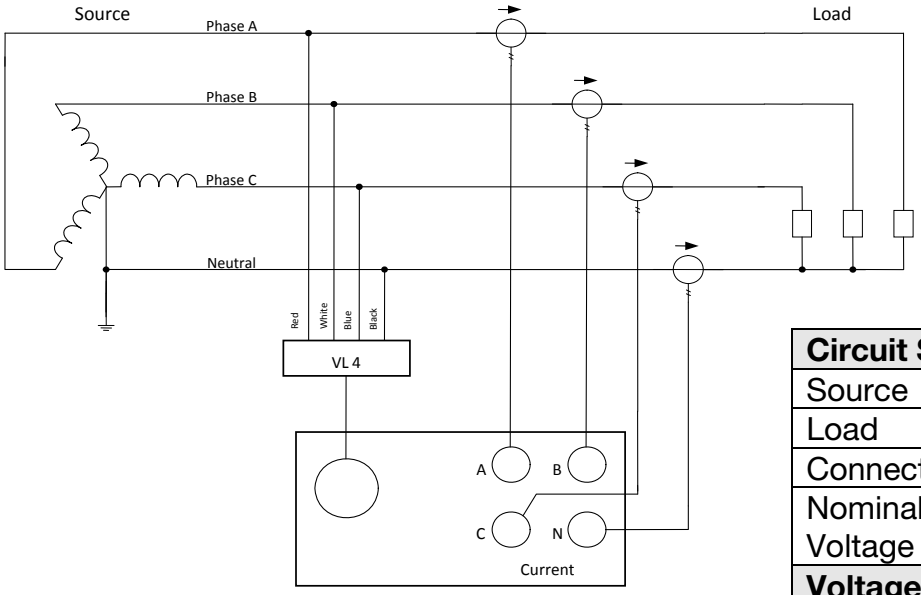
2. **Non-neutral line connection**. This includes connections 5.2, 5.3, 5.7 and 5.8. The phase-phase voltages and line currents are measured. The phase-phase voltages are converted to phase-neutral voltages and processed so that the centre of the phase-phase voltage triangle becomes the neutral point. This conversion is done point by point in the time domain so there is no assumption that the three phase system is balanced. For a balanced system, this is equivalent to applying a phase shift of 30 degrees and reducing the magnitudes by 3.

The phase-neutral voltages and line currents are processed to give:

- real power P
- reactive power Q
- apparent power S
- true power factor TPF
- displacement power factor DPF
- harmonic amplitudes and angles
- interharmonics
- other PQ measurements

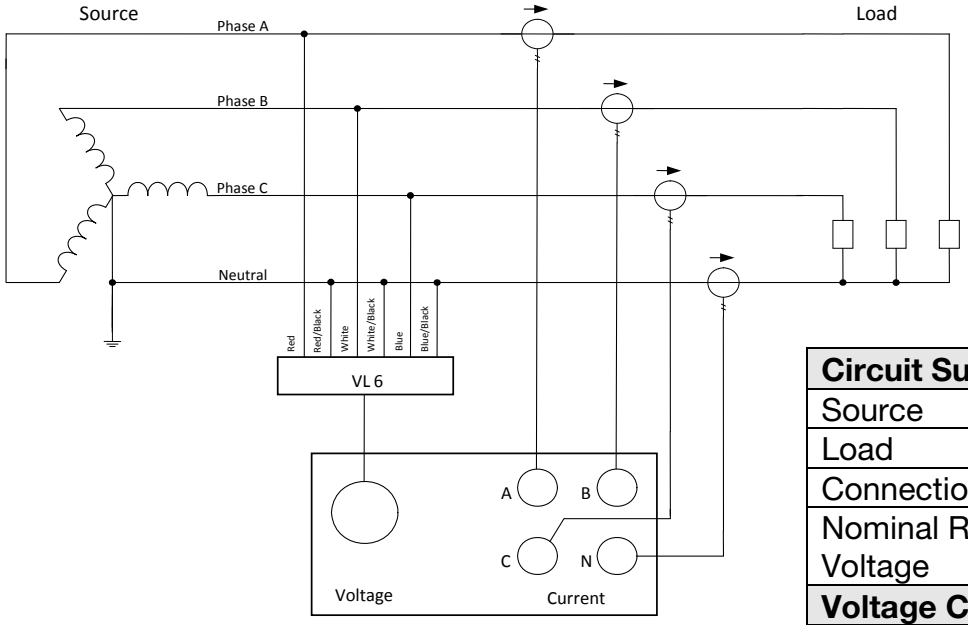
5.1 Three-Phase 4-Wire Wye Source with Wye Load (3P4W)

a. Connection Diagram using 4-Wire Voltage Cable (VL4)



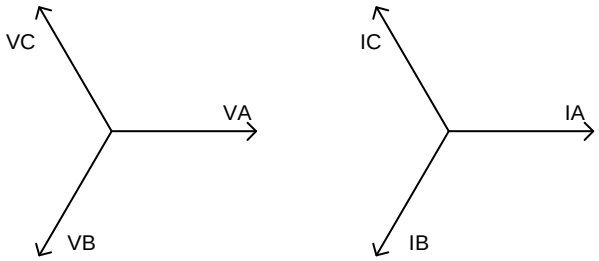
Circuit Summary Table	
Source	3-Phase Wye
Load	Wye
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral	Black

b. Connection Diagram using 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	3-Phase Wye
Load	Wye
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

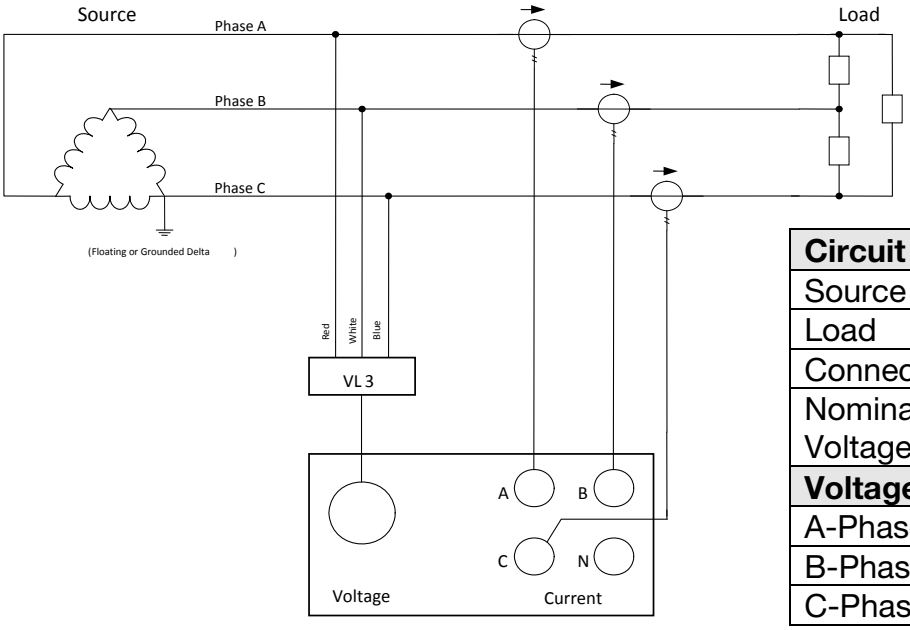
Phasor Diagram



This connection should be configured as **Star/Wye (3-phase, 4-wire)** using PowerView4

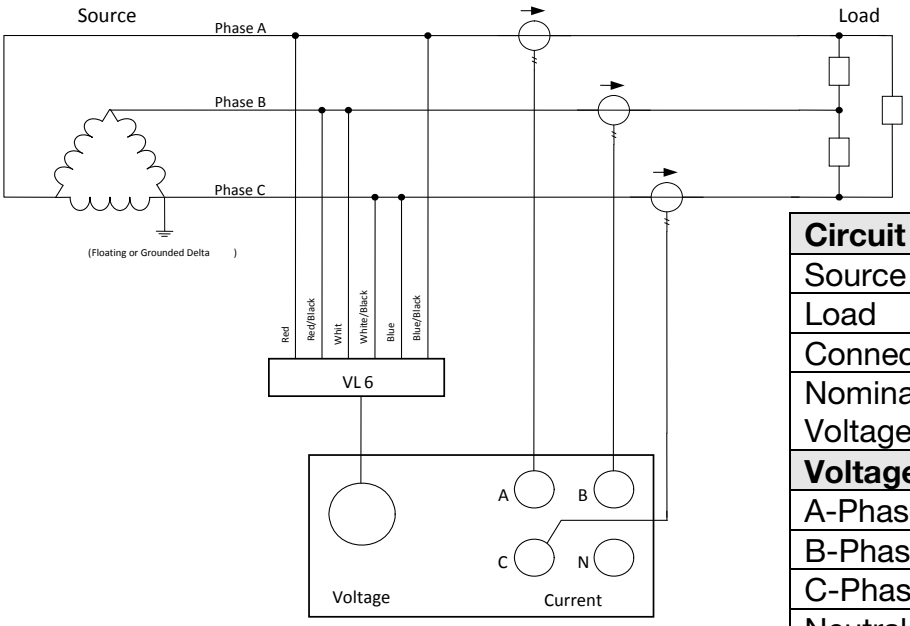
5.2 Three-Phase 3-Wire Delta Source with Delta Load (3P3W3M)

a. Connection Diagram using 3-Wire Voltage Cable (VL3)



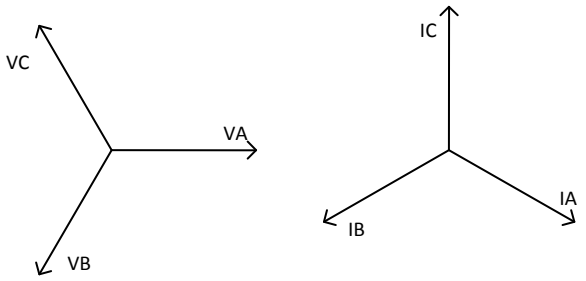
Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue

b. Connection Diagram using 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

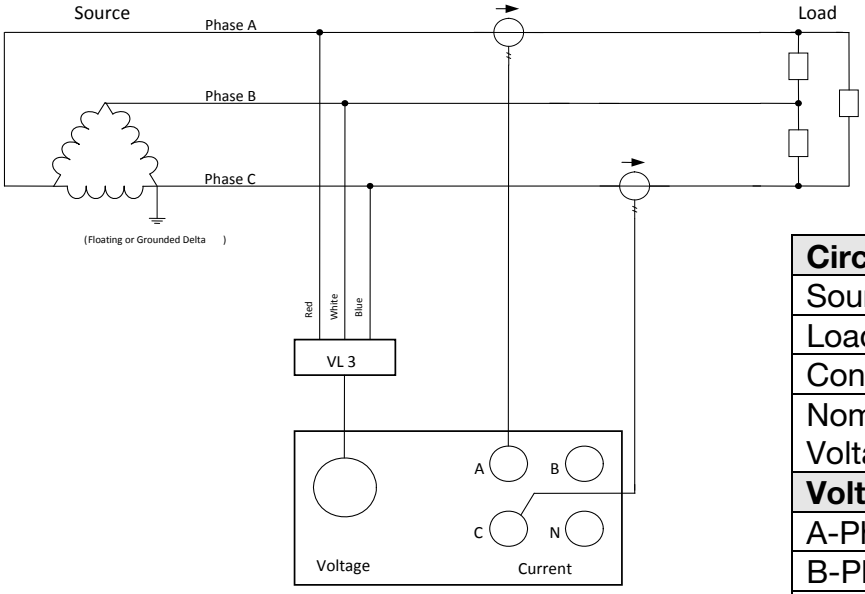
Phasor Diagram



Please note that this connection should be configured as Delta (3-phase, 3-wire) in PowerView

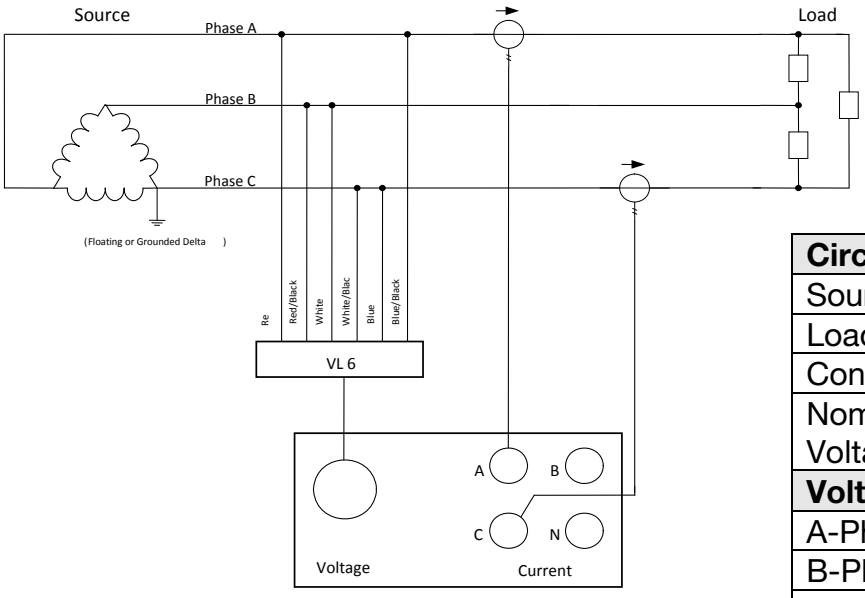
5.3 Three-Phase 2-Watt Delta Source with Delta Load – Standard (3P3W2W)

a. Connection Diagram using 3-Wire Voltage Cable (VL3)



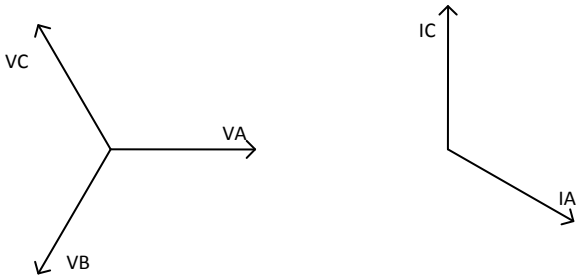
Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue

b. Connection Diagram using 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

Phasor Diagram

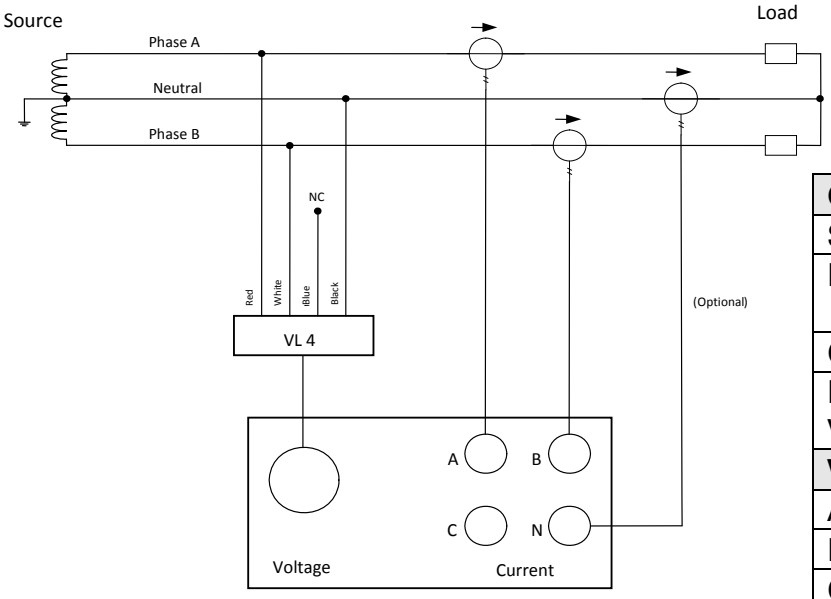


Please note that:

- The firmware version should be **V1.80** or later**.**
- This connection should be configured as Delta (3-phase, 2-wattmeter) in PowerView
- For a system with only 2 loads connect as above and configure the PowerMonic as Delta (3-phase, 2-wattmeter) in PowerView

5.4 Split Phase with 2 Single Phase Loads (1P3W)

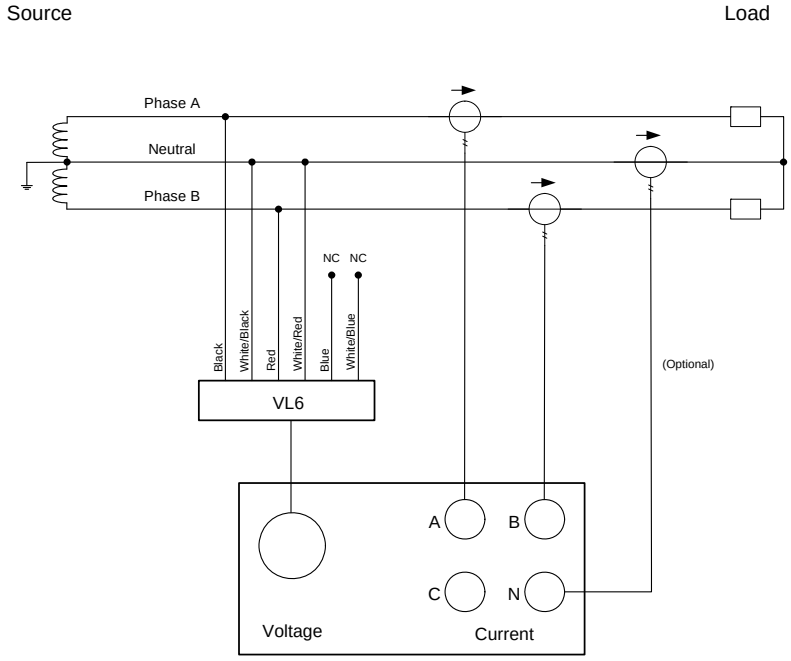
a. Connection Diagram using 4-Wire Voltage Cable (VL4)



Circuit Summary Table	
Source	Split Phase
Load	2 Single Phase
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral	Black

NC = Not Connected

b. Connection Diagram using 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	Split Phase
Load	2 Single Phase
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

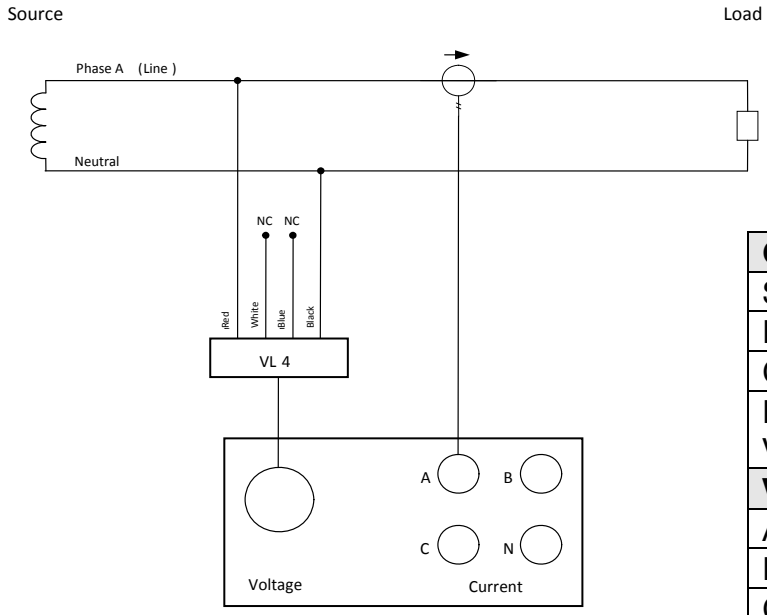
NC = Not Connected

Phasor Diagram

This connection should be configured as **Split Phase** using PowerView4 Single Phase (1P2W)

5.5 Three-Phase 4-Wire Wye Source with Delta Load

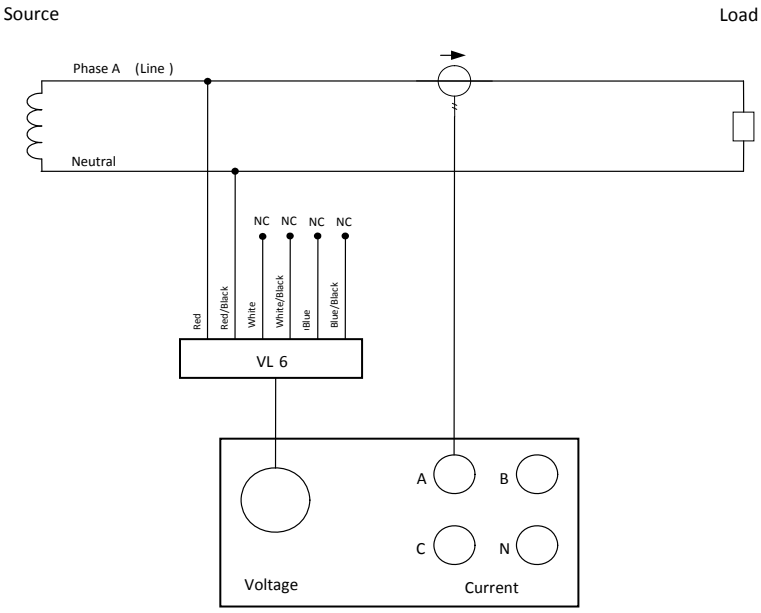
a. Connection Diagram using 4-Wire Voltage Cable (VL4)



Circuit Summary Table	
Source	Single Phase
Load	Single Phase
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral	Black

NC = Not Connected

b. Connection Diagram using optional 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	Single Phase
Load	Single Phase
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

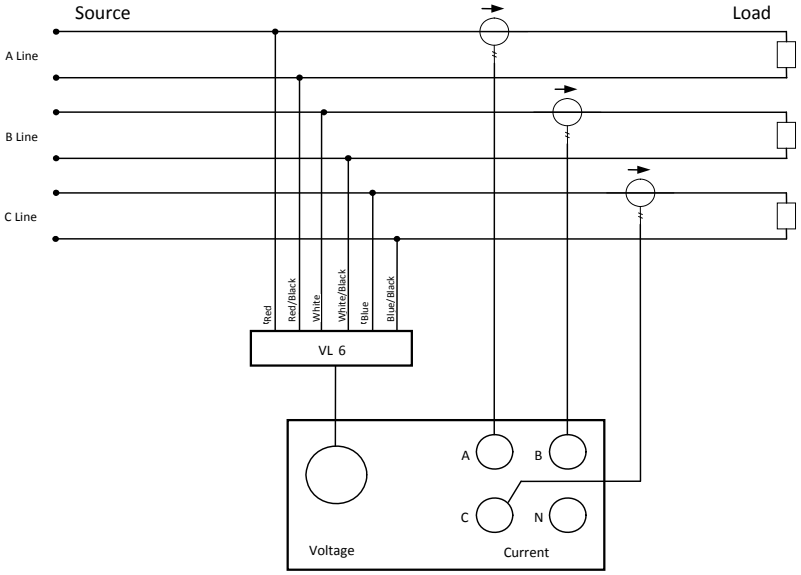
NC = Not Connected

Phasor Diagram

This connection should be configured as **Single Phase** using PowerView4

5.6 Generic, 3 independent circuits

Connection Diagram using 6-Wire Voltage Cable (VL6)



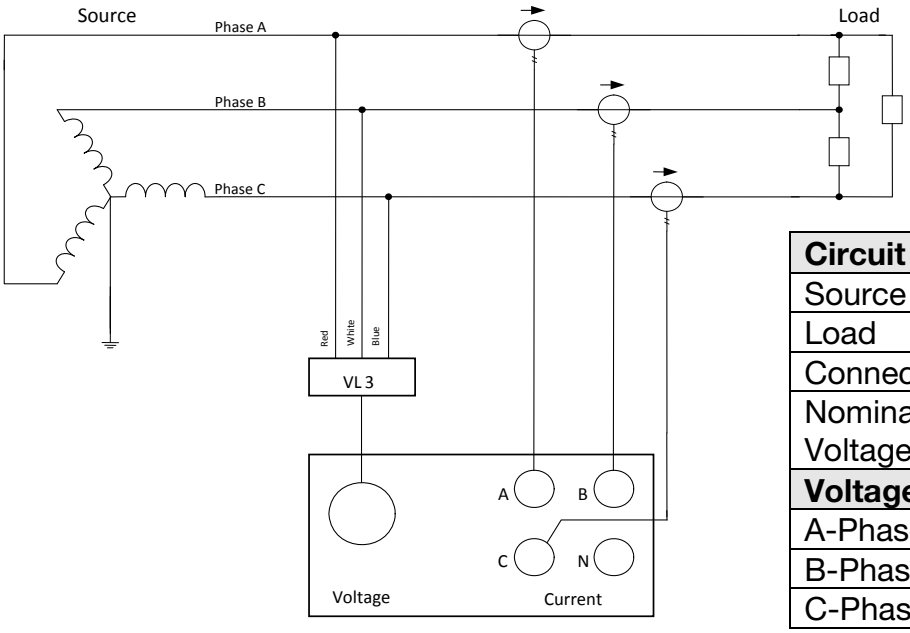
Circuit Summary Table	
Source	Generic
Load	3-Single Phases
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

Phasor Diagram

This connection should be configured as **Generic (independent measurement)** using PowerView4

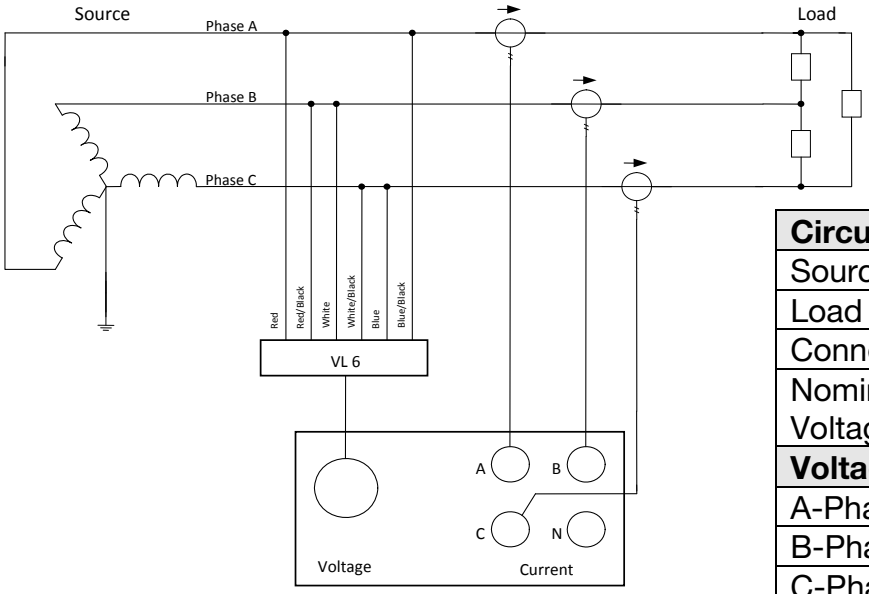
5.7 Three-Phase 4-Wire Wye Source with Delta Load

a. Connection Diagram using 3-Wire Voltage Cable (VL3)



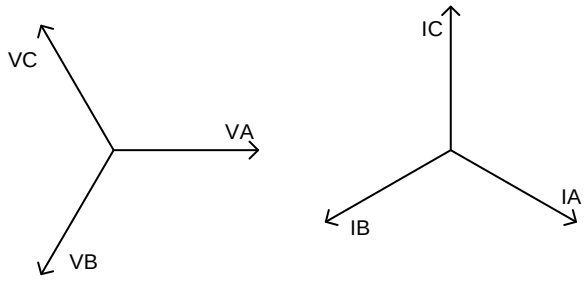
Circuit Summary Table	
Source	3-Phase Wye
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue

b. Connection Diagram using 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	3-Phase Wye
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

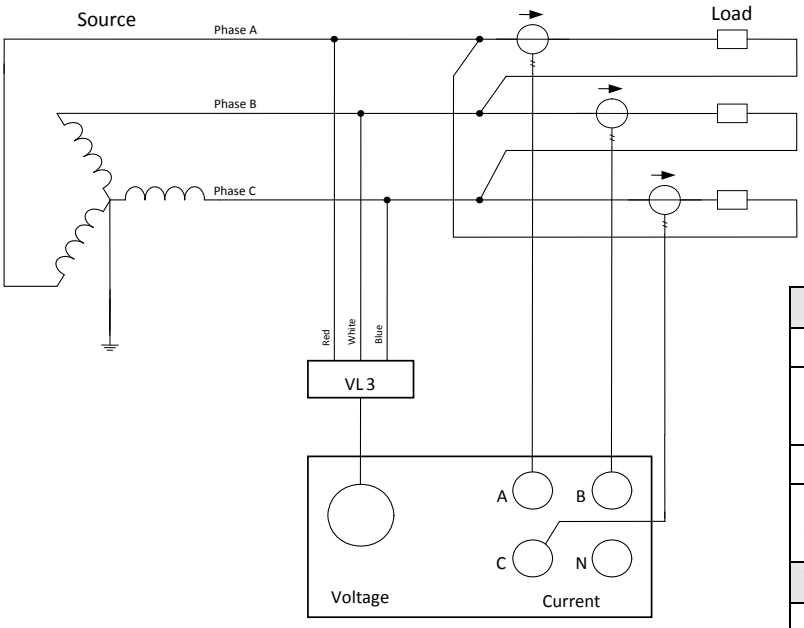
Phasor Diagram



This connection should be configured as **Delta (3-phase, 3-wire)** using PowerView4

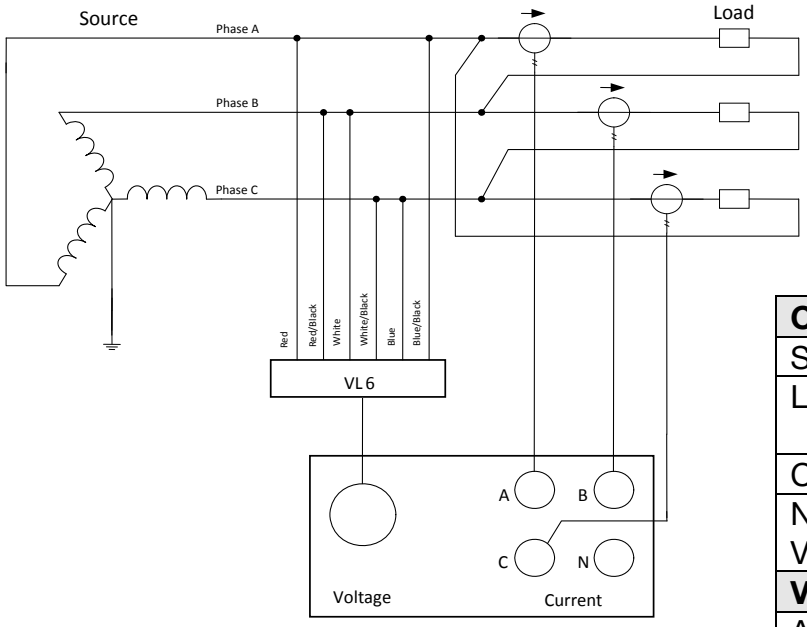
5.8 Three-Phase 4-Wire Wye Source with 3 Single Phase Loads

a. Connection Diagram using 3-Wire Voltage Cable (VL3)



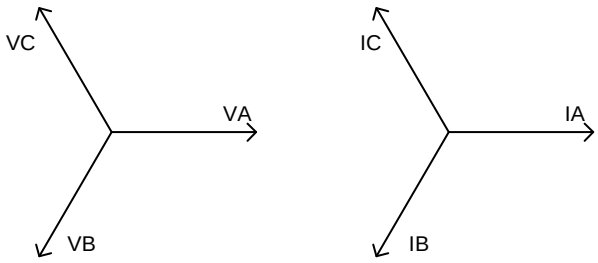
Circuit Summary Table	
Source	3-Phase Wye
Load	3 Single Phases
Connection	Star
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue

b. Connection Diagram using 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	3-Phase Wye
Load	3 Single Phases
Connection	Star
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

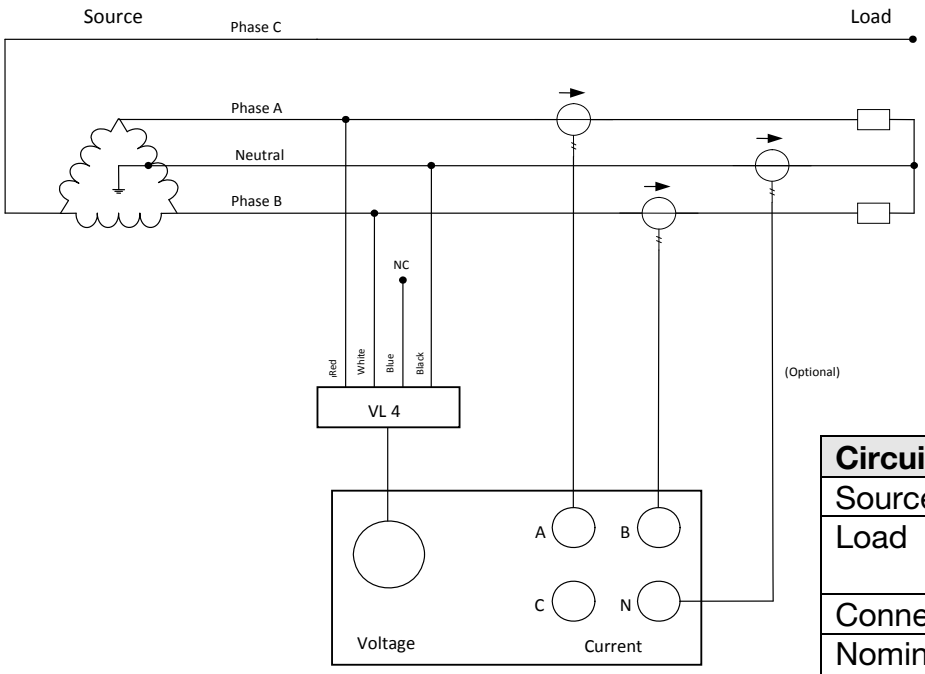
Phasor Diagram



This connection should be configured as **Generic (independent measurement)** using PowerView4

5.8 Delta Mid-Tap Source with 2 Single Phase Loads

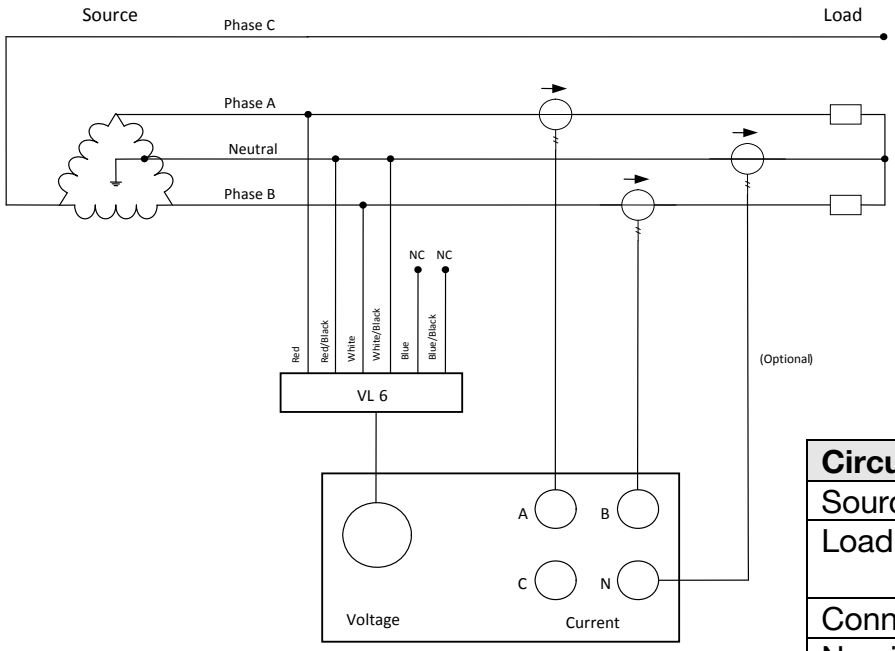
a. Connection Diagram using 4-Wire Voltage Cable (VL4)



Circuit Summary Table	
Source	Delta Mid Tap
Load	2-Single Phases
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral	Black

NC = Not Connected

b. Connection Diagram using 6-Wire Voltage Cable (VL6)



Circuit Summary Table	
Source	Delta Mid Tap
Load	2-Single Phases
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Red
B-Phase	White
C-Phase	Blue
Neutral-A	Red/Black
Neutral-B	White/Black
Neutral-C	Blue/Black

NC = Not Connected

Phasor Diagram

This connection should be configured as **Split Phase** using PowerView4.